STA-380 Exercises

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1. Probability practice

Part A

Given information:

Two categories of users:

1. Truthful clicker (TC)
2. Random clicker (RC)

Information on probablities:

- $P(RC) = 0.3$
- $P(Yes|RC) = 0.5$
- $P(No|RC) = 0.5$
- $P(TC) = 0.7$
- $P(Yes|TC) = x$
- $P(No|TC) = 1 - x$
- $P(Yes) = 0.65$
- $P(No) = 0.35$

Using the Rule of Total Probability,

$$P(Yes) = P(Yes, TC) + P(Yes, RC) = P(TC) * P(Yes|TC) + P(RC) * P(Yes|RC) \tag{1}$$

$$P(Yes) = 0.7x + 0.3 * 0.5 = 0.7x + 0.15 = 0.65$$

Solving for x, we get,

$x = P(Yes|TC) = 0.714$

Part B

We are being asked $P(Diseased|Positive)$

Given information:

- $P(Positive|Diseased) = 0.993$
- $P(Negative|NotDiseased) = 0.9999$
- $P(Diseased) = 0.000025$

According to Bayes Rule and Rule of Total Probability,

$$P(Diseased|Positive) = \frac{P(Positive|Diseased) * P(Diseased)}{P(Positive)} \tag{2}$$

and,

$$P(Positive) = P(Positive|Diseased) * P(Diseased) + P(Positive|Not\ Diseased) * P(Not\ Diseased) \tag{3}$$

Therefore,

$$P(Positive) = 0.993 * 0.000025 + 0.0001 * 0.999975 = 0.000125$$

Substituting in (2) we get,

$$P(Diseased|Positive) = \frac{0.993 * 0.000025}{0.000125} = 0.1986$$